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Parasitic Worms mainly from Celebes. Part 4. Trematodes of reptiles and birds

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Parasitic Worms mainly from Celebes. Part 4. Trematodes of reptiles and birds*

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Abstract

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PARASITIC WORMS MAINLY FROM CELEBES

Part 4. Trematodes of reptiles and birds

With 1 Plate

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I. TREMATODES OF REPTILES

1. *Cyathocotyle crocodili* n. sp. (Fig. 1)

Habitat and locality. Small intestine of *Crocodilus porosus*; Celebes.

Material. 5 gravid specimens fixed in acetic sublimate under cover glass pressure, stained and mounted as usual.

Body plump, 2.2–3.1 mm long, 1.2–1.3 mm wide. Tribocytic organ plug-shaped, 0.8–1.0 mm long by 0.7–0.8 mm wide, containing abundant glandular element at base, enclosed in a large sac which is formed by extension of the ventral body wall and whose inner wall is provided with strong circular muscle. This sac may be folded upon itself according to the state of contraction.

Oral sucker terminal, cup-shaped, rather weakly muscular, 0.16–0.2×0.2–0.27 mm, followed by a short prepharynx. Pharynx

subglobular, strongly muscular, $0.25-0.31 \times 0.32-0.37$ mm, three-lobed in front. Esophagus short; ceca simple, arcuate, terminating at posterior end of middle third of body, with their ends turned toward each other. Acetabulum weakly developed, $0.1-0.18$ mm in diameter, situated on the anterior face of the sac of the tribocytic organ.

Testes oval, $0.55-1.0 \times 0.3-0.55$ mm, placed one behind the other; the anterior dorsal, with its center at or just behind mid-body, the posterior ventral, near posterior extremity. Cirrus pouch subcylindrical, $0.8-0.9 \times 0.11-0.13$ mm, thin-walled, extending along dorsal wall of body to near level of anterior end of posterior testis or a little beyond this level. Vesicula seminalis elongate, with distinct epithelial lining, occupying greater anterior part of cirrus pouch, may or may not be constricted near its posterior end. Pars prostatica not differentiated. Ductus ejaculatorius muscular, winding, surrounded by a dense coat of accompanying cells, opening into genital atrium dorsal to uterus. Genital atrium wide, terminal.

Ovary round, $0.25-0.3$ mm in diameter, intertesticular in the type but may be pretesticular occasionally. Shell gland complex behind ovary, receptaculum seminis saccular, directly posterior to ovary and 60μ in diameter in the type. Uterine coils extending in median field as far forward as intestinal bifurcation or pharynx; metraterm muscular, running backward between posterior testis and cirrus pouch, opening into genital atrium immediately ventral to male aperture. Eggs rounded oval, light brown, $132-144 \times 105-114 \mu$ in life. Vitelline follicles large, commencing at level of pharynx or behind it, terminating at level of middle or posterior end of hind testis, encroaching upon base of sac of tribocytic organ; vitelline reservoir dorsal to posterior testis.

Excretory pore immediately ventral to genital pore; dorso-lateral stems reaching as far as anterior extremity.

This species differs from *Cyathocotyle fraterna* Odhner, 1902, probably in the size and structure of the tribocytic organ, for which Odhner does not seem to give any account whatever according to Dubois' citation of the original description. In Odhner's not yet fully mature, flattened specimen 1.5 mm long the oral and ventral suckers are 0.16 mm and 0.115 mm respectively, whereas the pharynx is only 0.1 mm in diameter. In my specimens, however, the

pharynx is definitely larger and much more strongly muscular than the oral sucker, measuring 0.25–0.31 mm long by 0.32–0.37 mm wide. The eggs are broader (105–114 μ) than those of Odhner's specimens found in the intestine of *Champse vulgaris* (Cuv.) from Egypt,

2. *Pseudoneodiplostomum* (*Pseudoneodiplostomoides*)
crocodili n. subg., n. sp. (Figs. 2 & 3)

Habitat and locality. Small intestine of *Crocodilus porosus*; Celebes.

Material. Six mature specimens fixed in acetic sublimate under cover glass pressure, stained and mounted in toto.

Body 3.7–6.6 mm long, divided into a more or less pointed lanceolate forebody 1.9–3.5 mm long by 1.17–1.35 mm wide and a subcylindrical hindbody 1.8–3.1 mm long by 0.6–0.97 mm wide, latter attached to posterodorsal side of former. Tribocytic organ longitudinally elongated elliptical, a little less than half as long as forebody, with median longitudinal slit, whose margin is provided with 29 to 35 papillae. Oral sucker 50–65 \times 47–65 μ , prepharynx extremely short or practically lacking, pharynx 48–72 \times 39–72 μ , esophagus 60–190 μ long; ceca narrow, terminating a short distance in front of posterior extremity (0.425 mm in the type 6.6 mm long). Acetabulum 108–132 \times 140–190 μ , situated at about junction of anterior with middle third of forebody.

Testes irregular in outline, tandem, 0.45–0.9 \times 0.63–0.85 mm, occupying greater middle portion of hindbody; anterior somewhat smaller than posterior, more attenuated at one end than at the other, more or less concave midventrally, with some posteriormost vitelline follicles on each side; posterior rounded quadrangular, occupying entire breadth of hindbody. Anterior vas efferens arising from right anteroventral part of anterior testis, distended with spermatozoa and winding in front of this testis, and uniting in median line with left vas efferens which arises from the left anteroventral part of the posterior testis and runs forward sinuously, filled with spermatozoa, on the left side of the body along with the ascending uterus. Vas deferens running backward alongside descending uterus in ventral median field. Vesicula seminalis winding just behind posterior testis as usual; ductus ejaculatorius joining small paraprostate at center of genital cone and opening at its

tip. Paraprostate narrow, tubular or claviform, with maximum diameter of $33\ \mu$, running in central axis of genital cone and reaching a little beyond its base. The genital cone projects out of the wide genital atrium which opens dorsally close to the posterior extremity and whose anterior border merges into the dorsal surface of the genital cone. Dorsally just in front of the genital cone is a small transverse pit whose anterior wall is covered with thick cuticle and surrounded by circular and radial muscle fibers, sometimes assuming a sucker-like appearance. When expanded this pit may form a "dorsal capsule" resembling that of *Cystodiplostomum*. In the median posteroventral wall of the genital atrium is another small oval pit, with its transversally elongated elliptical opening provided with strongly developed circular muscle fibers and directed toward the genital cone.

Ovary ovoid, $0.2-0.3 \times 0.3-0.4$ mm, situated usually a little to left of median line immediately in front of anterior testis with its long axis oblique to that of body. Laurer's canal opening mid-dorsally near anterior margin of anterior testis. Shell gland and vitelline reservoir intercalated between two testes; receptaculum seminis uterinum may be present. Uterus winding between ovary and median excretory reservoir lying immediately behind tribocytic organ, opening into genital atrium at base of genital cone on its ventral side. Eggs large, elliptical, $108-126 \times 72-90\ \mu$. Vitelline follicles small, extending along ceca from level of acetabulum or behind it to level of anterior testis. Main excretory system of fore-body consisting of paired lateral vessels running parallel to ceca and joining together dorsal to pharynx, where they unite with the median stem ascending from the acetabulum. Between the acetabulum and the tribocytic organ is a tubular or saccular median reservoir; and behind the tribocytic organ is another saccular median reservoir of somewhat irregular outline. The two conspicuous lateral stems running throughout the length of the hind-body unite with each other at the posterior end of the body to open ventroterminally without forming a definite vesicle.

This subgenus differs from the type subgenus of *Pseudoneodiplostomum* Dubois, 1936, in the possession of two sucker-like pits, one in front of the genital cone dorsally, and the other in the posteroventral wall of the genital atrium, though resembling in general anatomy, especially in the terminal genital ducts which provide

the most important criteria in distinguishing *Proterodiplostomid* genera.

Pseudoneodiplostomoides n. subg.

Subgeneric diagnosis. *Pseudoneodiplostomum* Dubois, 1936: Forebody lanceolate; hindbody subcylindrical, attached to dorsal side of forebody. Tri-bocytic organ longitudinally elongated elliptical, less than half as long as forebody with median slit bordered by numerous papillae. Oral sucker and pharynx small, esophagus short, ceca terminating short of posterior extremity. Acetabulum larger than oral sucker, about twice as far from posterior end of forebody as from anterior extremity. Testes irregularly rounded, tandem, occupying greater middle portion of hindbody. Ductus ejaculatorius joining paraprostata before opening at tip of genital cone. Paraprostata small, tubular or claviform, in central axis of genital cone. Genital atrium wide, opening dorsally near posterior extremity, with posteroventral diverticle, whose opening is provided with strong circular muscle. Dorsally just in front of the genital cone is a slit-like pit which may be expanded like the dorsal capsule of *Cystodiplostomum*. Ovary submedian, occasionally median, immediately pretesticular. Laurer's canal opening outside dorsal to anterior testis. Uterus coiled in front of ovary, opening into genital atrium at its base ventrally. Vitellaria extensive in forebody, commencing at or behind level of acetabulum and terminating on each side of anterior testis. Vitelline reservoir and shell gland intertesticular. Excretory pore ventro-terminal. Parasitic in intestine of crocodiles.

Type species: *Pseudoneodiplostomum* (*Pseudoneodiplostomoides*) *crocodili* n. sp.

Upon careful re-examination of the original material, *Neodiplostomum crocodilarum* Tubangui et Masilungan, 1936, may be referred to the present new subgenus. It differs, however, from *P. crocodili* in the eggs being much narrower.

3. *Acanthostomum crocodili* n. sp. (Fig. 4)

Habitat and locality. Small intestine of *Crocodilus porosus*; Celebes.

Material. 5 mature specimens fixed in acetic sublimate, stained and mounted in toto.

Body flattened cylindrical, 5.6–6.8 mm long, 0.55–0.65 mm at level of acetabulum; anterior extremity truncate, posterior extremity blunt-pointed. Cuticle beset throughout with minute spines. Oral sucker terminal, cup-shaped, $0.37-0.4 \times 0.36-0.4$ mm; circumoral spines 23 in number without exception, arranged in a single row, measuring $63-80 \mu$ by $17-30 \mu$, midventral spines smaller than middorsal ones, lateral ones $70-80 \times 23-27 \mu$. Pre-

pharynx wide, 0.06–0.25 mm long. Pharynx 0.21–0.25×0.18–0.21 mm. Esophagus short, bifurcating in front of middle of anterior third of body. Ceca simple, opening dorsolaterally very close to posterior tip of body. Acetabulum round, 0.3 mm in diameter, situated behind middle of anterior third of body.

Testes ovoid, 0.35–0.58×0.31–0.4 mm, situated one directly behind the other near posterior extremity, anterior one at middle of posterior third of body. Vesicula seminalis winding behind acetabulum, with maximum width of 0.1–0.13 mm at its posterior swelling which is very strongly constricted off from the remaining portion, and lies longitudinally at the junction of the anterior with the middle third of the body on the right of the median line. Pars prostatica 0.19–0.21 mm long by 20–25 μ wide, surrounded by prostate cells, joining with metraterm dorsal to acetabulum to form a hermaphroditic duct 0.25–0.29 mm long. Genital atrium opening immediately in front of acetabulum by a wide transversely elongate aperture. To this genital atrium is attached anterodorsally a subglobular body 0.09–0.1 mm long by 0.1–0.11 mm wide and enclosed in a thin membrane. It consists of closely massed gland ducts coming from the compact mass of gland cells in the surroundings, and is not a mere muscular bulb though it looks like this under low power magnification.

Ovary ovoid or subglobular, 0.3–0.35×0.21–0.24 mm, situated on the left of median line in the anterior half of caudal third of body. The germiduct, arising from the dextrodorsal side of the ovary, joins the short duct from the seminal receptacle and Laurer's canal on the right of the ovary in front of the receptaculum seminis and then receives the vitelline duct. Receptaculum seminis large, ovoid, 0.3–0.42×0.22–0.31 mm, situated in median line or a little to the right posterodorsal to ovary, pressed against anterior testis, giving off a short duct at its anterior end. Laurer's canal running backwards arcuately, opening outside dorsal to seminal receptacle. Uterus coiled from side to side between ovary and seminal vesicle, overreaching ceca ventrally, then confined to right side of vesicula seminalis. Eggs oval or somewhat pyriform, embryonated, with a distinct operculum and a prominent opercular ridge, measuring 27–33 μ long by 14–17 μ wide in life. Vitelline follicles surrounding ceca on all sides except the medial, commencing at level of posterior end of seminal vesicle or a little more posteriorly, and reach-

ing to posterior testis, where they terminate usually at about the middle, occasionally at different levels (at the anterior or posterior end of the organ on one side, but about the middle on the other). Vitelline reservoir median, immediately anterior to receptaculum seminis.

Excretory vesicle Y-shaped, with terminal pore; stem reaching to posterior end of acetabulum; arms extending as far as level of pharynx or prepharynx.

The differences between this species and the allied members of the genus, *A. atae* and *A. elongatum* (both by Tubangui and Masiluñgan, from Palawan *Crocodilus porosus*) and *A. diploporus* Stunkard are shown in the following table. Unless otherwise indicated all measurements are in mm.

	<i>A. diploporus</i>	<i>A. atae</i>	<i>A. elongatum</i>	Present species
Body	2.6-3.3 × 0.3-0.39	4.1-5.5 × 0.3-0.5	10.8-16.3 × 0.5-0.85	5.6-6.8 × 0.55-0.65
Oral sucker . .	0.25-0.32 × 0.14-0.21	0.17-0.32 × 0.22-0.32	0.3-0.32 × 0.34-0.42	0.37-0.4 × 0.36-0.4
Oral spines . . .	24	25-26	21	23
Pharynx	— × 0.13- 0.146	0.12-0.15 × 0.08-0.13	0.17-0.24 × 0.13-0.17	0.21-0.25 × 0.18-0.21
Acetabulum . . .	— × 0.13- 0.18	0.12-0.18 × 0.12-0.19	0.3-0.36 × 0.31-0.36	— × 0.3
Posterior extent of vitellaria . .	anterior end of posterior testis	anterior testis	in front of ovary	usually middle of posterior tes- tis
Eggs in μ	20-28 × 11-13	30.7-34.5 × 15.3-17.2	26.8-32.6 × 15.3-17.2	27-33 × 14-17
Host	alligator	<i>Crocodilus porosus</i>	"	"

Tubangui and Masiluñgan simply state that the ceca reach to near the posterior end of the body, but there is no doubt that they open to the exterior at the posterior extremity in the Philippine species, too, as is the case with *A. diploporus* Stunkard and the present species.

In body size and relative position of the suckers and of the internal organs the present species resembles *A. atae* more closely than any other species, but differs distinctly in the number of the oral spines, in the posterior extent of the vitellaria, etc.

II. TREMATODES OF BIRDS

4. *Plagiorchis maculosus* (Rud., 1802)

Habitat and locality. Intestine of *Sturnia philippinensis* (Forster) and *Passer montanus*; Macassar.

Material. A single specimen from the first host was fixed in acetic sublimate, stained and mounted in toto, another from the second host was examined in life for the details of the excretory system. The following measurements were made on the specimen from the first host.

Body flattened elliptical, about 2 mm long by 0.65 mm broad. Cuticle beset throughout with minute spines. Oral sucker subterminal, 0.188×0.225 mm. Cervical gland cells strongly developed in lateral neck region, their numerous ducts opening along anterior margin of oral sucker. Prepharynx present. Pharynx $80 \times 115 \mu$, three-lobed in front. Esophagus lacking. Ceca turning backward, posterolateral to oral sucker, terminating near posterior extremity. Acetabulum 0.2 mm in diameter, situated at junction of anterior two thirds of body.

Testes round, $0.26 - 0.27 \times 0.225 - 0.24$ mm, obliquely tandem, the right posterior one at junction of posterior two thirds of body. Cirrus pouch elongate, 0.6×0.075 mm, arched in front of acetabulum, with the posterior end reaching to anteromedial end of ovary. Vesicula seminalis 0.27 mm long, occupying entire width of posterior portion of cirrus pouch, constricted near its anterior end. Pars prostatica not distinctly differentiated though prostate cells are present. Ductus ejaculatorius narrow, convoluted. Cirrus smooth, not forming a special terminal swelling. Genital pore immediately anterosinistral to acetabulum.

Ovary subglobular, 0.22×0.2 mm, situated on the right of median line at anterior part of middle third of body. The germiduct arises from the ovary on the dorsal side near its posteromedial end, and proceeds anteromedially toward the shell gland, giving off the Laurer's canal before it joins the vitelline reservoir. At the point of origin of the Laurer's canal is seen a small receptaculum seminis. The Laurer's canal describes an S-shaped curve and opens middorsally at the level of the transverse vitelline ducts. The uterus descending between the two testes occupies the whole posttesticular intercecal field as far back as the posterior extremity.

The metraterm curves round the right margin of the acetabulum and crosses the distal end of the cirrus pouch dorsally just before opening into the common genital pore. Eggs oval, $30-36 \times 19-21 \mu$. The vitelline follicles extend along the intestine on its dorsal, ventral and outer sides from a short distance in front of the genital pore to the posterior end of the body. The retort-shaped vitelline follicles lies posteromedial to the ovary between the germiduct and the descending proximal portion of the uterus.

Excretory vesicle Y-shaped, with ventroterminal pore; the stem passes between the two testes, the right arm reaches to near the posterior end of the ovary, whereas the left arm extends over the anterior end of the left testis; the collecting duct arising from the anterior end of the arm runs forward sinuously and divides anterolateral to the acetabulum into two vessels, one of which is directed forward and the other backward, each subdividing into two tubules. Since each of these tubules terminates in two capillaries, there are altogether 16 flame cells, the formula being $2[(2+2) + (2+2)] = 16$.

The present record will serve to provide a positive evidence for the wide geographical distribution of the parasite.

The posterior extent of the cirrus pouch being subject to considerable variation in the members of this genus does not constitute by itself a decisive criterion in specific determination.

5. *Echinochasmus bagulai* Verma, 1935. (Fig. 5)

Habitat and locality. Small intestine of *Gorsakius goisagi* (Temm.); Macassar.

Material. Numerous gravid specimens fixed in acetic sublimate under cover glass pressure, stained and mounted in toto.

Body approximately spatulate, 0.77–1.35 mm in length, with maximum width of 0.26–0.4 mm at middle third or a little more posteriorly, covered all over with scale-like spines except for posterior dorsal surface; forebody tapering anteriorly, containing residue of larval penetration glands on either side of esophagus; hindbody rounded behind, with nearly parallel or convex sides. Head collar 95–150 μ in transverse diameter, with 12 spines in two alternate rows on each side, end group spines 4, $21-30 \times 5-8 \mu$; other marginal spines $21-30 \times 6-7 \mu$. The rows of the collar spines are distinctly separated one from the other dorsal to the oral sucker,

which projects forward very prominently and measures $45-65\mu$ by $45-70\mu$. Prépharynx narrow, $50-75\mu$ long. Pharynx subglobular, $50-70\times 50-75\mu$. Esophagus $60-150\mu$ long; its short anterior portion is cuticular like the prepharynx, but the remaining greater part is similar in structure to the intestine, and lined with ciliated epithelium. It may form a bulbous dilatation at the anterior end of this pseudo-esophagus. I have been unable to detect "small glands" on its wall as observed by Verma. Ceca approaching each other and terminating blindly near posterior extremity. Acetabulum $135-195\mu$ in diameter, situated at anterior part of middle third of body, occasionally encroaching upon anterior third.

Testes entire or indented, rarely lobed, $0.06-0.15\times 0.1-0.22$ mm, situated one directly behind the other at about middle of post-acetabular intercecal field or a little more posteriorly; the anterior is much broader than long and pressed against the posterior, which is also a little broader than long and may be rounded triangular. Cirrus pouch oval or pyriform, thin-walled, $75-120\times 42-80\mu$, immediately behind intestinal bifurcation, overlapping acetabulum on its dorsal side. Vesicula seminalis bipartite, $22-60\mu$ in diameter, the posterior portion usually the larger. Pars prostatica small, bulbous, at anterior end of cirrus pouch; prostate cells filling up entire available space within cirrus pouch. Cirrus represented by a short narrow passage between genital pore and pars prostatica. Genital pore postbifurcal, median.

Ovary round, $45-75\times 45-80\mu$, situated on the right of median line immediately in front of anterior testis. The germiduct, arising from the dorsal side of the ovary, forms a bulbous swelling before giving off the Laurer's canal, and then turns back on itself to join the vitelline reservoir. Shell gland on the left of ovary. Laurer's canal opening dorsally on the left submedian line at level of ovary. Uterus forming a few transverse coils in intercecal field between anterior testis and acetabulum; eggs few (not more than 20), oval, $66-75\times 42-51\mu$ in life. Vitelline follicles commencing at level of posterior end of acetabulum, confluent behind posterior testis, vitelline ducts running transversely along anterior margin of anterior testis, at the middle of which a small triangular reservoir is formed.

Excretory pore dorsoterminal; vesicle Y-shaped, with heart- or funnel-shaped dilatation at posterior end, stem as well as arms

giving off wide side branches. Two wide inner branches running between the acetabulum and the intestinal arch narrow abruptly at the medial end and unite with each other dorsal to the genital pore. Another transverse anastomosis occurs between the ovary and the anterior testis on the dorsal side of the transverse vitelline ducts.

Though not perfectly agreeing with the description of *Echinochasmus bagulai* given by Verma, the present worm may safely be referred to this Indian species.

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Explanation of Plate

- Fig. 1. *Cyathocotyle crocodili* n. sp., lateral view.
 Fig. 2. *Pseudoneodiplostomum* (*Pseudoneodiplostomoides*) *crocodili*, n. subg., n. sp., dorsal view.
 Fig. 3. Posterior extremity of same, dorsal view.
 Fig. 4. *Acanthostomum crocodili* n. sp., dorsal view.
 Fig. 5. *Echinochasmus bagulai* Verma, 1935, dorsal view.

Abbreviations used in Figures

a = acetabulum, an = anus, cp = cirrus pouch, dh = ductus hermaproditicus, ep = excretory pore, ev = excretory vesicle, ga = genital atrium, gp = genital pore, hf = holdfast organ, i = intestine, lc = Laurer's canal,

o = ovary, os = oral sucker, p = pharynx, pg = proteolytic gland, pp = paraprostata, rs = receptaculum seminis, s = suckerlike structure, t = testis, u = uterus, ve = vas efferens, vr = vitelline reservoir, vs = vesicula seminalis, vsi = vesicula seminalis interna, vt = vitellaria.

YAMAGUTI: PARASITIC WORMS MAINLY FROM CELEBES—TREMATODES OF REPTILES & BIRDS

